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Heise

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(54) **HEATING APPARATUS AND SYSTEM USING SUCH APPARATUS**

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Related U.S. Application Data

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(51) **Int. Cl.**[7] **H05B 1/00**
(52) **U.S. Cl.** **219/213**; 219/535; 219/540
(58) **Field of Search** 219/213, 535, 219/530, 540

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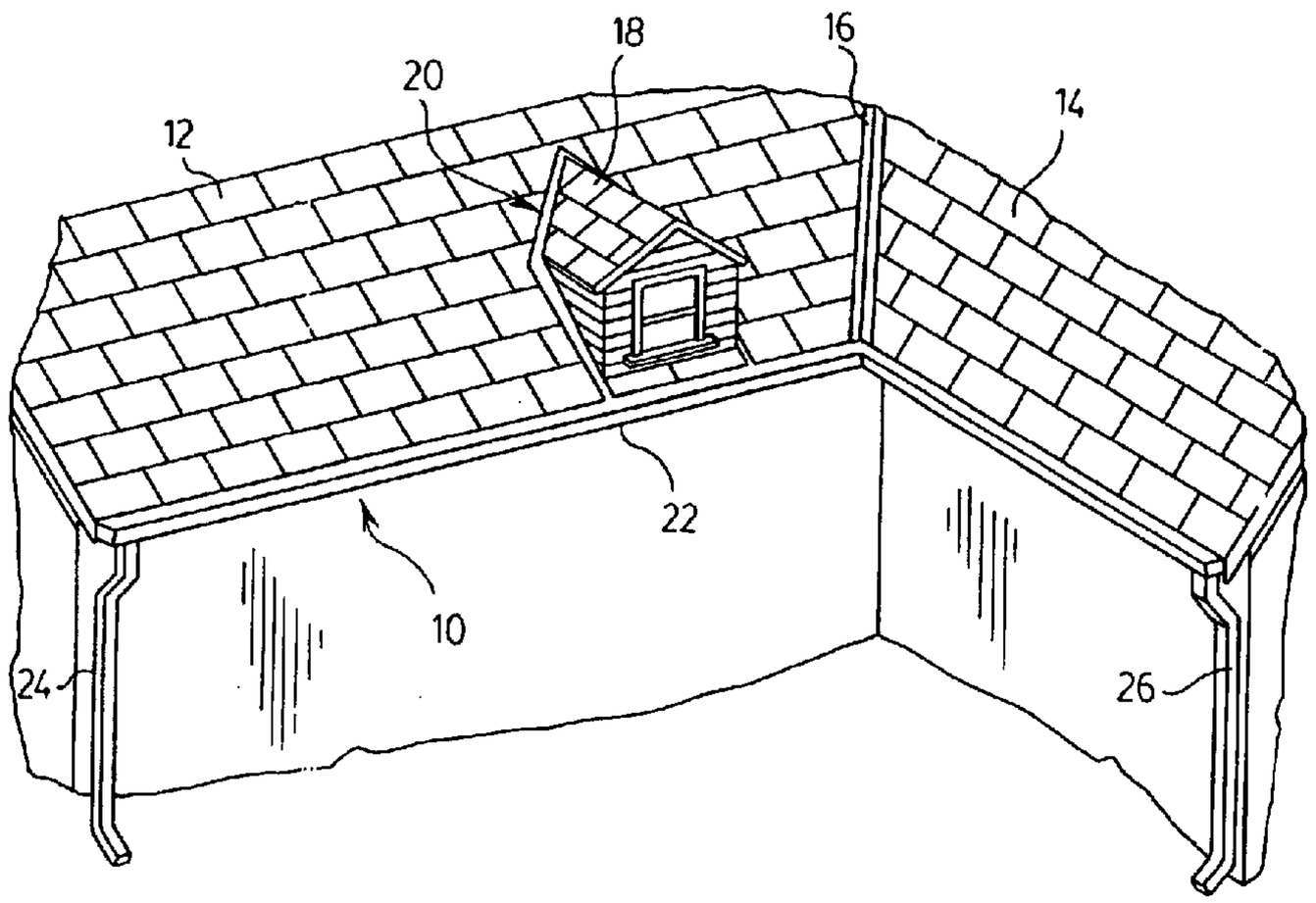
(57) **ABSTRACT**

Heating apparatus comprising a body of conducting material having oppositely directed surfaces extending between the edges, a channel formed one of the surfaces and defined by a pair of walls upstanding from the one surface, and a cover cooperating with the walls to define an enclosed passageway to receive a heating cable.

13 Claims, 5 Drawing Sheets



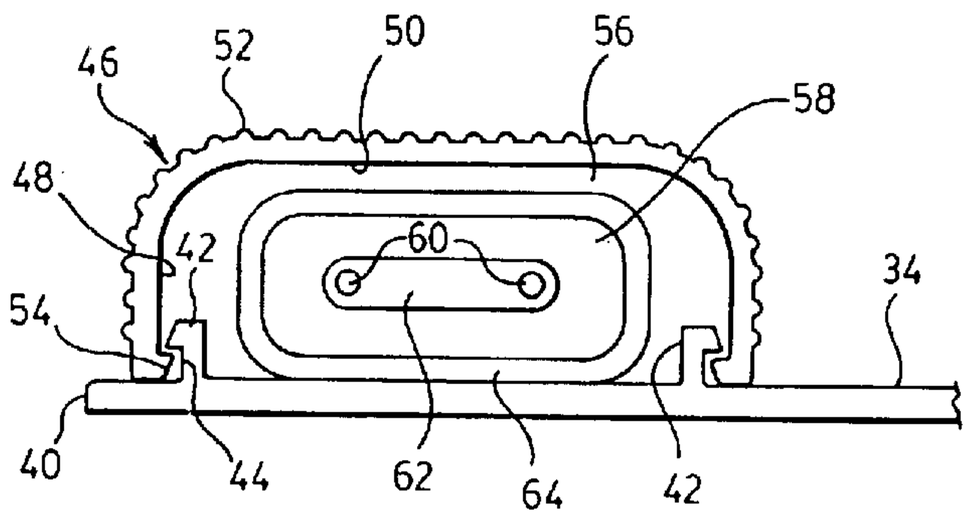


FIG. 1.

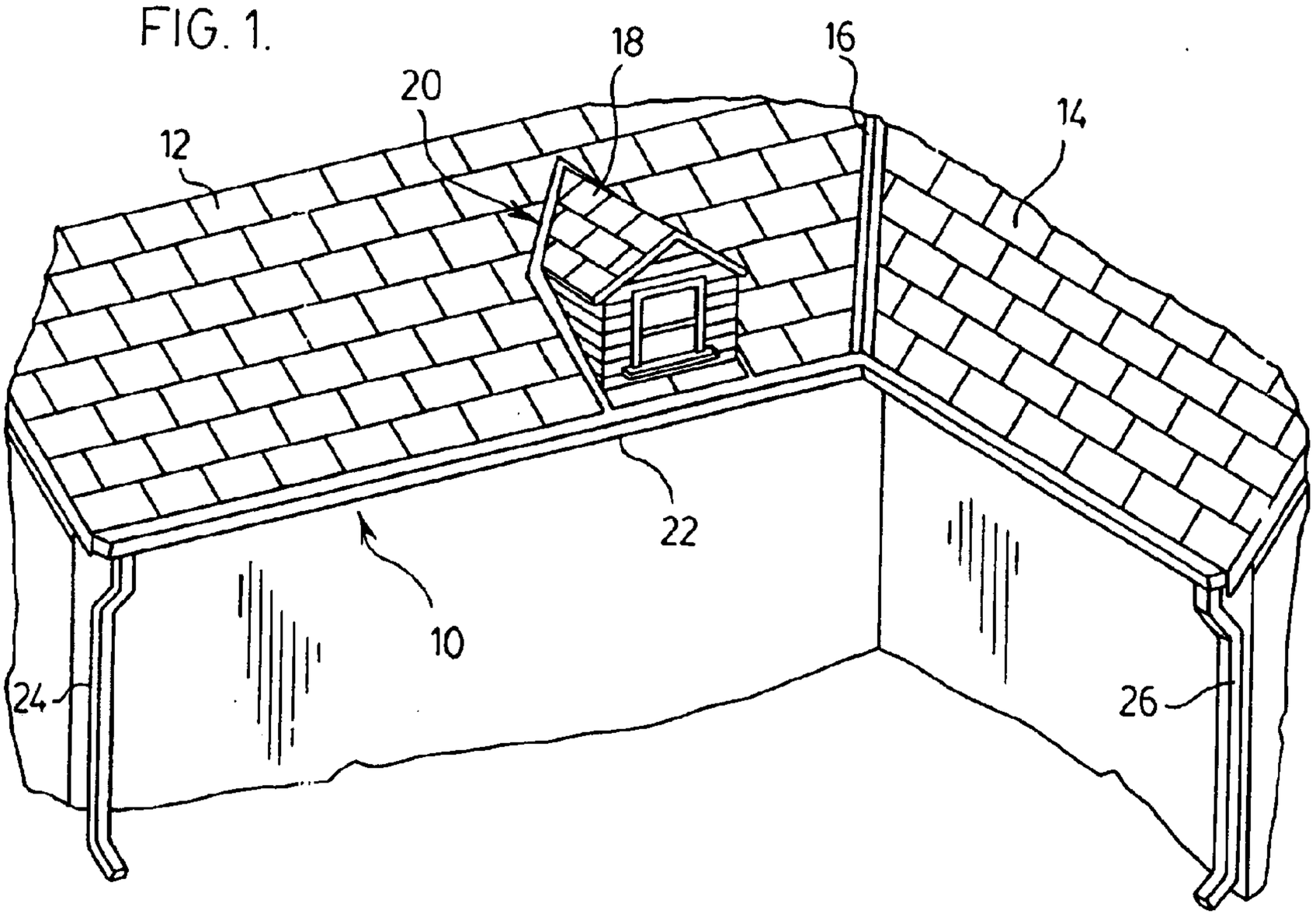


FIG. 2.

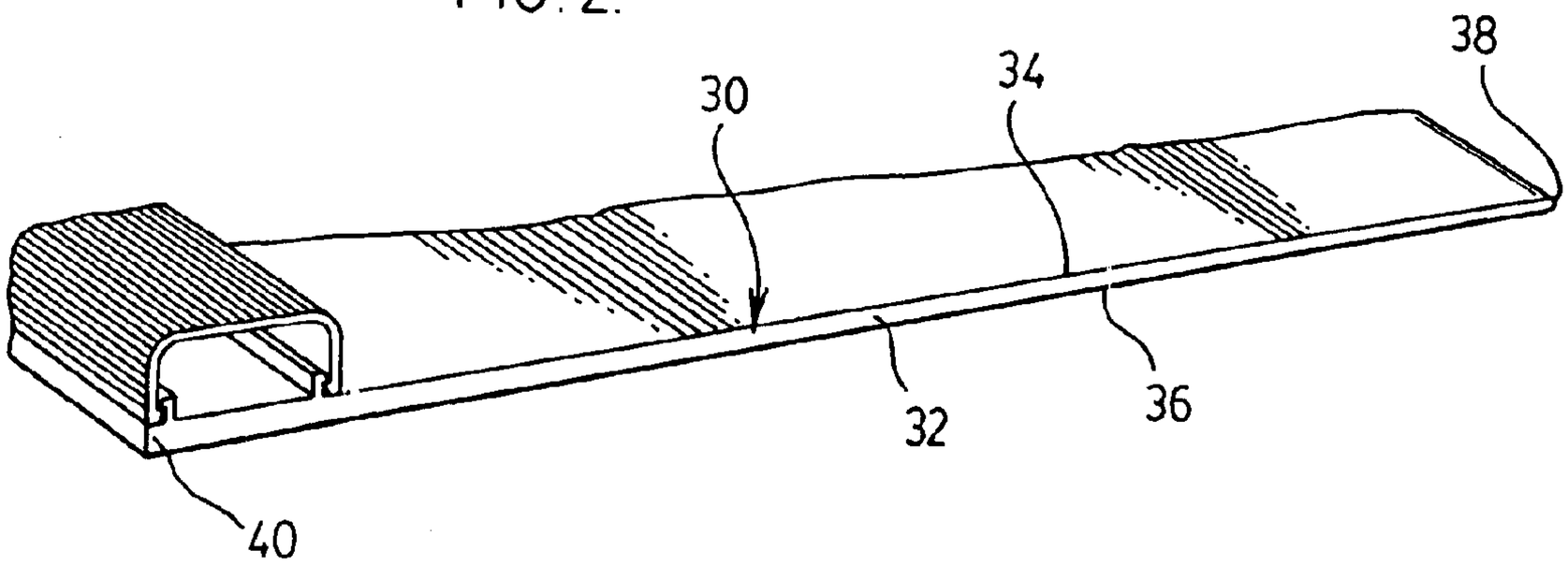


FIG. 3.

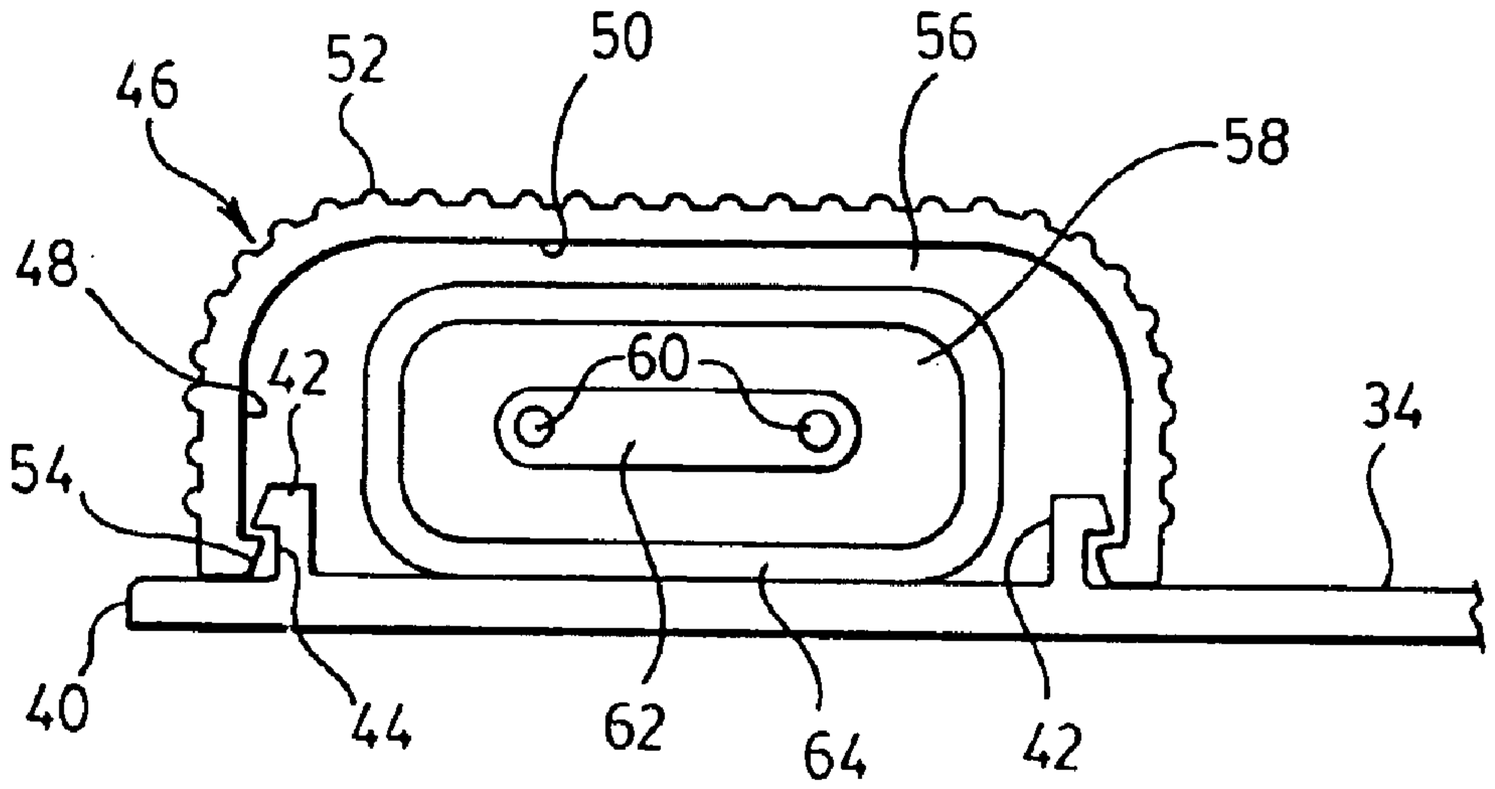
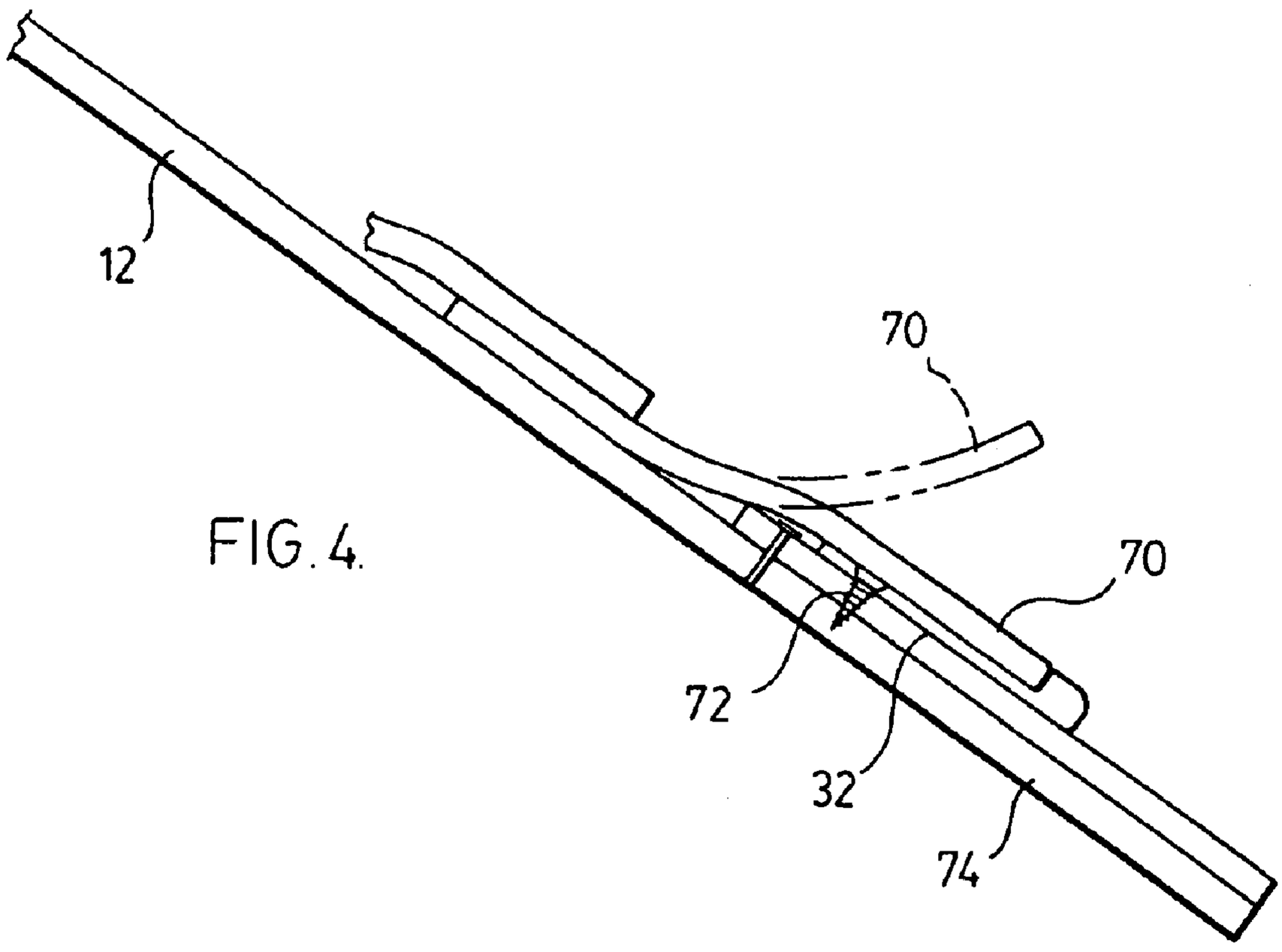


FIG. 4.



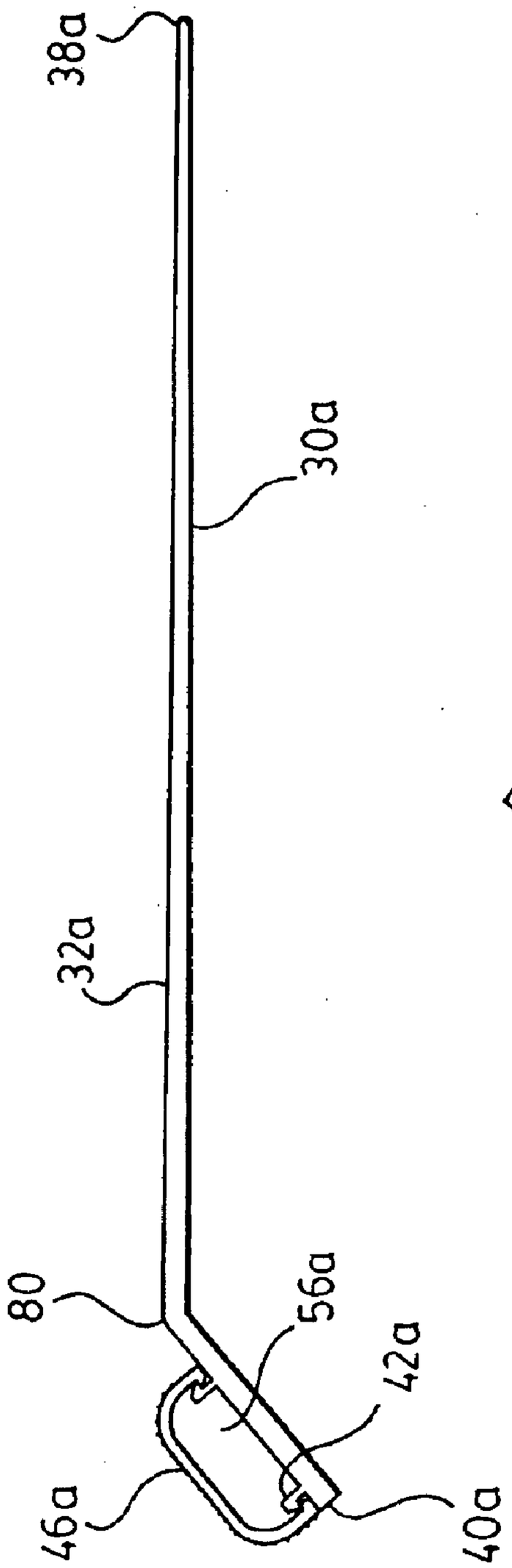


FIG. 5.

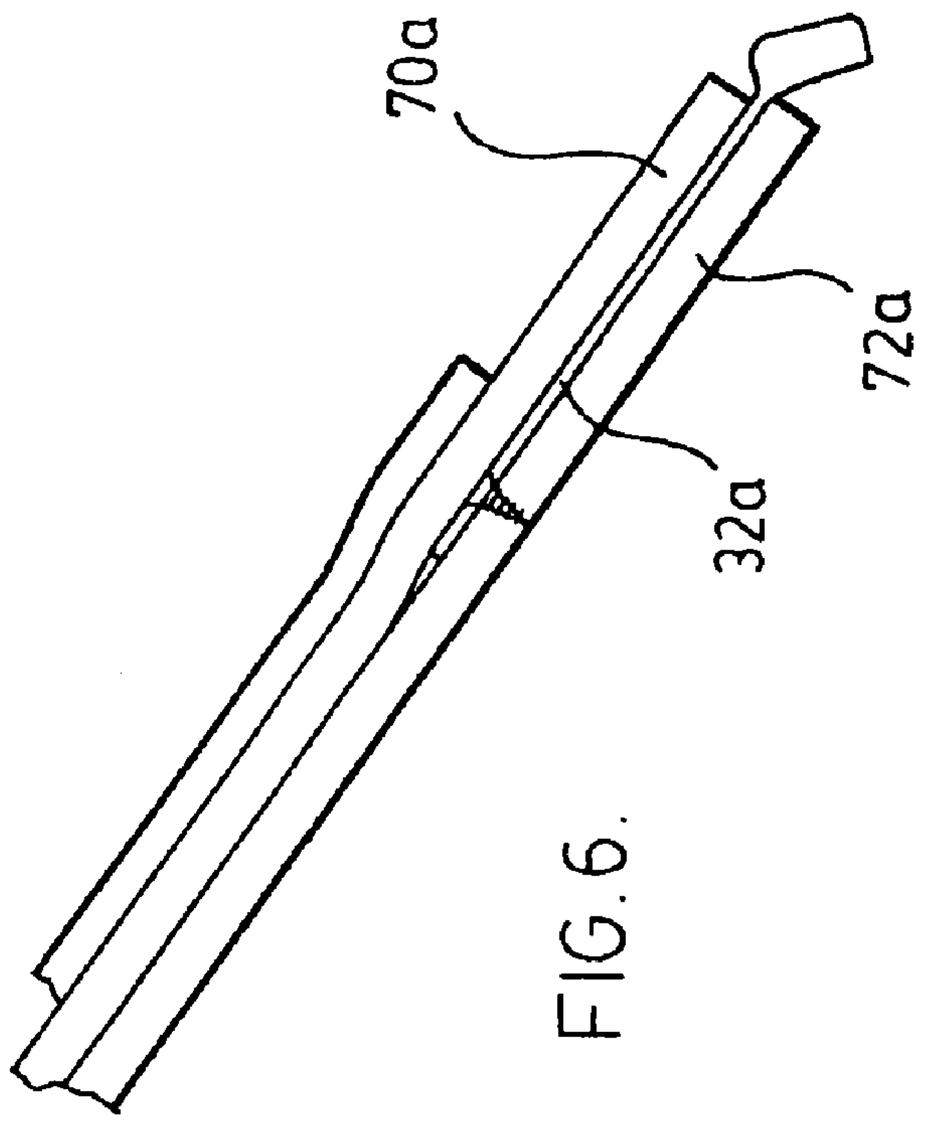


FIG. 6.

FIG. 7.

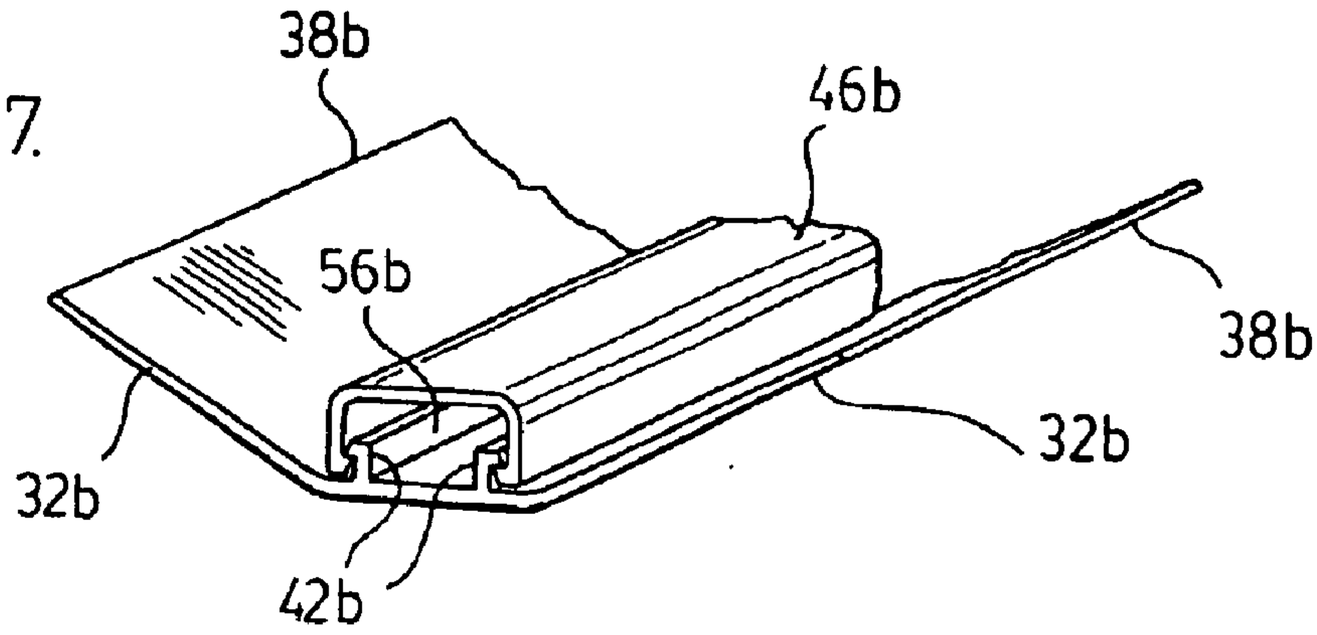


FIG. 8.

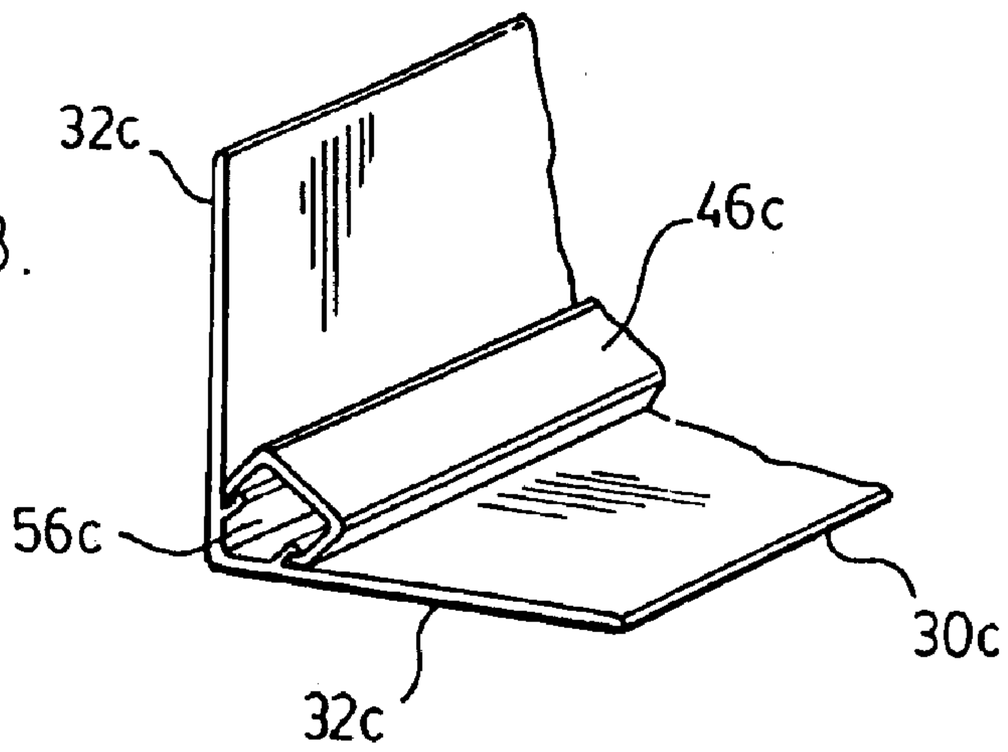


FIG. 9.

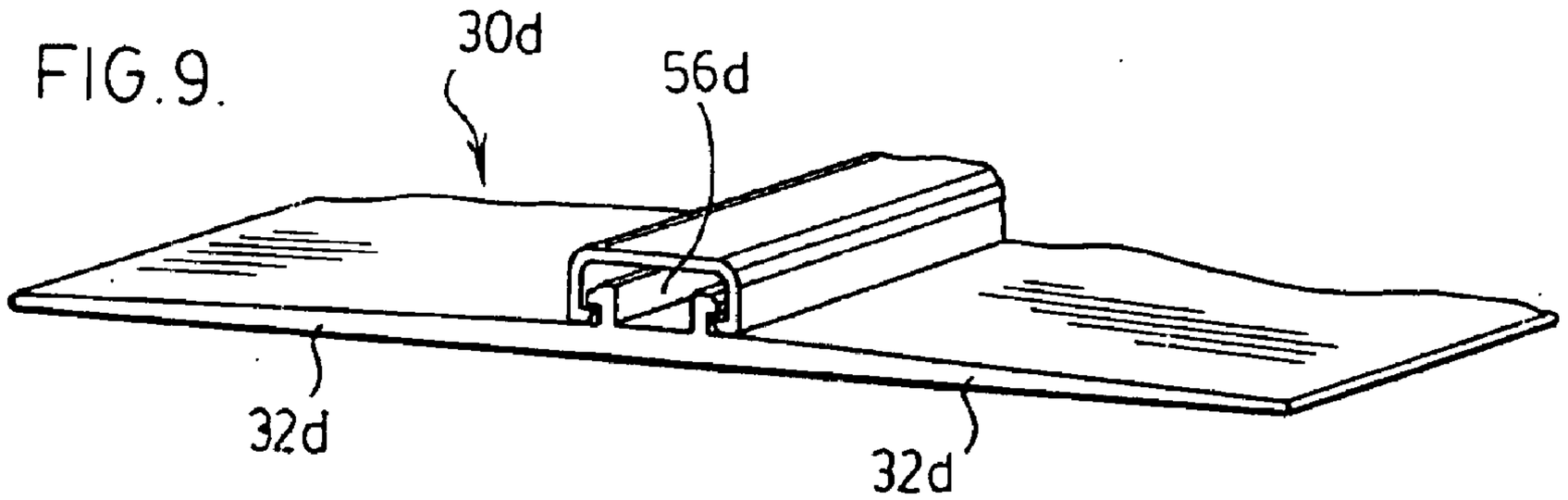
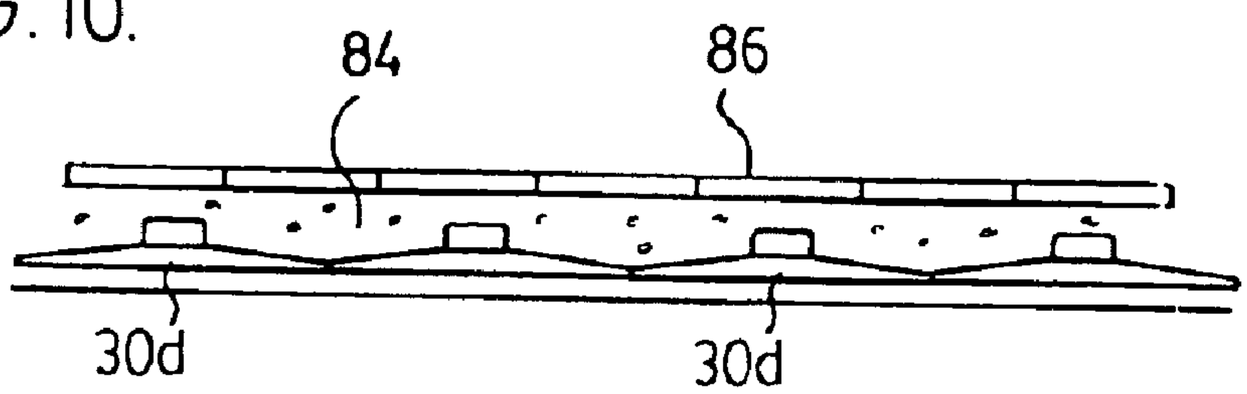


FIG. 10.



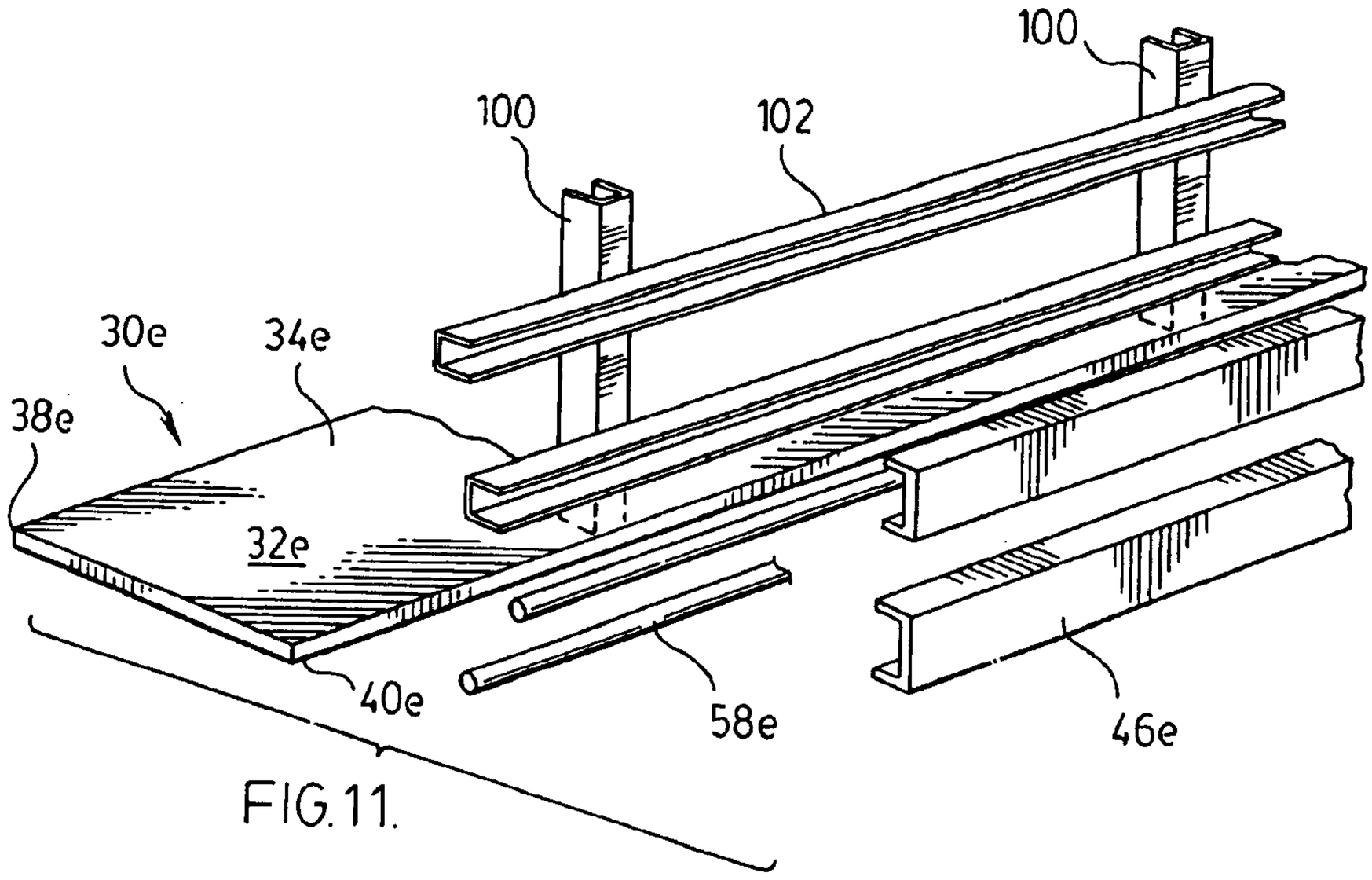
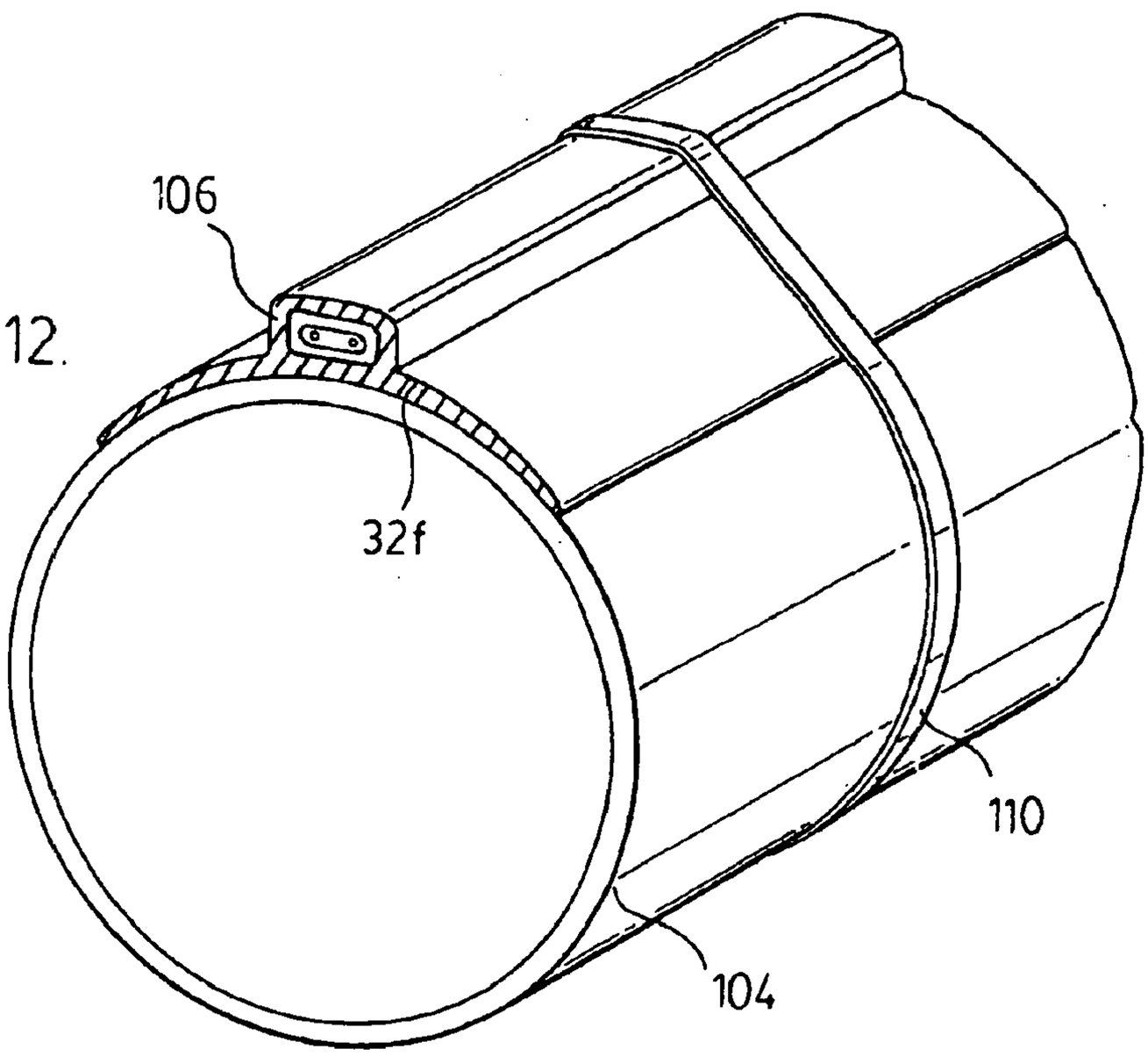


FIG. 11.

FIG. 12.



HEATING APPARATUS AND SYSTEM USING SUCH APPARATUS

The application claims priority from U.S. Provisional Application No. 60/352,598, filed Jan. 31, 2002.

FIELD OF THE INVENTION

The present invention relates to heating apparatus and systems using such apparatus.

BACKGROUND OF THE INVENTION

It is well known that ice build up on planar surfaces such as roofs may cause physical damage to the structure and also pose a hazard to people passing near to such structures. Typically the build up of ice and snow on a building is caused by localised freeze and thaw cycles that generates an ice dam at a particular locations along the roof These ice dams prevent the drainage of the roof and may cause penetration of moisture through the roof if left unattended.

It is known to provide localised heating at the edge of the roof by a heating cable secured to the roof by clips. The heating cable can be activated to melt any accumulation of ice and snow that may occur on the edge of the roof. With such installations, the cable is left relatively exposed and the effect of the heating cable is localised. For this reason a serpentine installation is frequently used to extend the area over which heat is applied.

However the heating effect achieved from the cable is relatively local and leaves the cable exposed to damage from the snow, ice and other external factors.

It is therefore an object of the present invention to provide a heating apparatus to obviate or mitigate the above disadvantages.

In general terms, the present invention provides heating apparatus comprising a body of conducting material having a pair of laterally spaced edges, oppositely directed surfaces extending between said edges, a channel formed on one of the surfaces and defined by a pair of walls upstanding from said one surface, and a cover co-operating with the walls to define an enclosed passageway to receive a heating cable.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will now be described by way of example only with reference to the accompanying drawings in which:

FIG. **1** is a perspective view of a house;

FIG. **2** is a perspective end view of a heating apparatus for installation on the house of FIG. **1**;

FIG. **3** is an enlarged view of a portion of the heating apparatus shown in FIG. **2**;

FIG. **4** is a side view of the heating apparatus of FIGS. **2** and **3** installed on a roof of the house of FIG. **1**;

FIG. **5** is a end view similar to FIG. **2** of an alternate embodiment;

FIG. **6** is a view similar to FIG. **4** utilising the embodiment of FIG. **5**;

FIG. **7** is a perspective view of a further embodiment of heating apparatus;

FIG. **8** is a perspective view of a still further embodiment of the apparatus;

FIG. **9** is a perspective view of a further embodiment of the apparatus;

FIG. **10** is a schematic representation of an alternative use of the apparatus shown in FIG. **9**; and

FIG. **11** is a perspective view of a further embodiment of the heating apparatus.

FIG. **12** is a perspective view of a further embodiment applied to a pipe.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring therefore to FIG. **1**, a house **10** has a roof **11** formed in part by a pair of intersecting roof panels **12**, **14** which define a valley **16** at their intersection. A dormer window **18** is located in the roof to define further valleys **20** at its intersection with the plane of the roof **12**. An eavestrough **22** extends around the lower periphery of the roof and has a pair of down spouts **24**, **26** to convey water from the eavestrough **22** to the ground.

A number of areas on the roof **11** of house **10** pose a significant risk of ice build up due to various environmental factors including freeze/thaw cycles or the loss of heat from the house itself. To avoid the ice build up the heating apparatus shown in FIGS. **2** through **11** is utilised on different areas on the house as will be described more fully below.

Referring therefore to FIG. **2**, a heating apparatus **30** has an elongate body **32** with upper and lower faces **34**, **36**. The body **32** extends between a pair of laterally spaced edges **38**, **40** and tapers from a tip **38** to a butt end **40** such that the spacing between the surfaces **34**, **36** progressively increase from the tip **38** to the butt end **40**. As can be seen more clearly in FIG. **3**, a pair of upstanding barbs **42** are integrally formed adjacent the butt end **40** on the upper surface **34**. The barbs **42** are undercut as indicated at **44** to allow a cap **46** to be secured to the body **32**.

The cap **46** is generally D-shaped with a pair of limbs **48** extending from an intermediate portion **50**. The outer surface of the cap **46** is ribbed as indicated at **52** to increase the surface area of the outer surface of the cap. The lower end of the limbs **48** have barbs **54** complimentary to the undercut **44**. Each of the barbs **42**, **54** are shaped to permit the cap **46** to be engage with and be snapped onto the barb **44** to retain the cap on the body **32**.

The cap **46** and body **32** co-operate to define a cavity **56** within which is located a heating cable **58**. The heating cable **58** is of known design and is of a self regulating construction with a pair of conductors **60** electrically connected by a carbon filament **62**. The cable includes a protective outer sheath **64** and operates to provide a heating effect that is proportional to the ambient temperature. Thus the lower the temperature from a pre-set meld point the greater the heating effect. Such a cable is well known and is available from Heat-Line Corporation, Canarvon, Ontario under the trademark Paladin I.

The body **32** and cap **46** are formed from a highly conductive material, typically aluminium. The body **32** is dimensioned to coincide with the dimensions of courses of shingle applied to the roof panels **12** and **14**. In a typical application, the body **32** is in the order of 6.65 inches from the tip **38** to the butt end **40** with the barb **42** closest to the tip **38** spaced 0.7 inches from the butt end **40**. The length of the body **32** may be of any convenient length, typically 4 foot lengths and the thickness of the body **32** at the butt end **40** is in the order of 0.1 of an inch. The cavity **56** will typically be in the order of 0.65 inches between the barbs and in the order of 0.25 deep. These dimensions are of course typical and may vary according to particular applications or physical dimensions. Typically the body **32** and cap **46** may be extruded and subsequently cut to length to

suit. A suitable aluminium alloy is 6063 T5 although other alloys may be utilised. The outer surfaces **34, 36** of the body **38** may be covered by barrier materials such as Mylar to inhibit galvanic corrosion when used in combination with metal roofing or fastenings.

The apparatus **30** is installed on the roof panel **12** at a location proned to ice build up. As indicated in FIG. **4**, this may be at a location spaced from the lower edge of the roof panel **12**. The apparatus **30** is installed by lifting a shingle **70** to expose the underlying shingle and the body **32** then secured by a screw **72**, nail or adhesive or other fastening to the underlying shingle and roof deck **74**. The apparatus **30** is positioned so that the cap **46** is adjacent to the lower end of the shingle **70** and will run horizontally along the lower edge of the run of shingles. The shingle **70** may then be replaced to cover the body **38** with the tapered cross-section of the body **38** providing a minimum disturbance to the line of the shingles. After installation, the cable **58** is located between the barbs **42** and the cap **56** then snapped into place. The end of the cable is connected to a suitable power source on the outside of the house and may in fact be fed within the down spouts **24** to provide a heating effect and maintain the down spouts clear of ice.

Sufficient of the apparatus **30** is installed to extend along the roof panel in the area where the ice is likely to form. The apparatus **30** are laid end to end with a small gap between adjacent units to permit contraction and expansion.

In operation, power is supplied to the cable **58** that provides a self regulating heating effect within the channel **56**. The heat is transferred through the body **32** beneath the shingle **70** which is in contact with the upper surface **34**. The heat is thus transferred over a substantial area through the shingle and into the ice or snow causing it to melt and drain down the roof. As the temperature fluctuates, the heating effect similarly fluctuates and an ice free roof panel is maintained under varying conditions. Naturally, the power source may be used intermittently or may be left in with its self regulation providing economical use of electricity.

As illustrated in FIG. **4**, the apparatus **30** is installed away from the edge of the roof panel **12**. An alternative embodiment as shown in FIG. **5** is particularly useful for use at the edge of the roof panel and like components will be identified with like reference numerals with a suffix "a" added for clarity. In the embodiment of FIG. **5**, the body **32***a* of the apparatus **30***a* is cranked as indicated at **80** between the tip **38***a* and butt end **40***a*. A cap **46***a* is secured on barbs **42***a*. The crank **80** will typically provide an included angle in the order of 140° and is spaced in the order 5.6 inches from the tip **38***a*.

The heating apparatus **30***a* is installed in the manner shown in FIG. **6** is similar to the shown in FIG. **4**. The body **32***a* is located beneath the first run of shingles **70***a* with the crank **80** located on the edge of the sheathing **72***a*. The chamber **56***a* thus depends below the lower edge of the shingles and provides a heating effect at the edge of the roof panel **12** which is transferred through the body **32***a* into the lower most run of the shingles **80***a*. Again the broad band effect of the heating enables the lower edges of the roof panel to be maintained free of ice and the cable **58***a* located securely within the channel **56***a* below the sight line of edge of the roof **11**.

The valley areas **16, 20** are also susceptible to the build up of ice and the embodiments shown in FIGS. **7** and **8** are useful in these locations. Again like components will be identified with like reference numerals with a suffix "b" and "c" respectively provided for clarity. In FIG. **7**, the body **32***a* extends on either side of the cap **46***b* and is cranked to provide an inclination corresponding to the included angle in the valley **16**. The relatively malleable nature of the aluminium alloy facilitates the adjustment of the inclination so as to match the included angle with each of the bodies **32***b* tapering towards their tips **38***b*. The cap **46***a* is secured as a snap fit on barbs **42***b* so that the heating table **58** may pass along the cavity **56***b* along the axis of the valley **16**. Thus heat is transferred through the bodies **32***b* into the adjacent shingles as well as the valley itself to promote the thawing of ice build up in that location.

The embodiment of FIG. **8** is particularly useful in the valleys **20** where walls may intersect at 90°. Bodies **32***c* extend from either side of a channel **56** formed between the cap **46***b* and an apex defined by the intersection defined by the bodies **32***c*. Barbs **42***c* project upwardly from each of the bodies **32***c* to allow a snap fit of the cap **46***c*. The unit **30***c* may thus be fitted adjacent the walls in the valleys **20** to provide a heating effect on the lower edge of the wall and the adjacent shingles.

In a further embodiment shown in FIG. **9**, the body **32***d* extends to either side of the channel **56***d* but is essentially planar so it may be fitted to a horizontal surface such as a flat roof to provide drainage channels. The unit **30***d* is particularly useful in maintaining eavestroughs clear of ice, particularly the wide eavestroughs found on commercial and industrial buildings.

The embodiment of FIG. **9** may also be used to provide a heating effect to walkways or floors by being placed side by side as shown in FIG. **10** beneath the floor. The apparatus **30***d* is embedded within a mortar **84** and capped with a wear surface **86**. The cables may then be run through the channels **56***d* with the bodies **32***d* distributing the heating effect over a wide area through the mortar and to the overlay **86**.

The heating effect of the cables **56** may also be incorporated into a snow fence for use on roofs as indicated in FIG. **11**. Snow fences are used to inhibit the discharge of snow from roofs en masse. As shown in FIG. **11**, a heating apparatus **30***e* includes a body **32***e* extending from a tapered tip **38***e* to the butt end **40***e*. A pair of supports **100** extend upwardly from the upper surface **34***e* adjacent the butt end **40***e*. The supports **100***e* carry a pair of channel members **102** extending horizontally parallel to the butt end **40***e*. The channels include a pair of barbs to receive a cap **46***e* and define an enclosed channel. The cable **58***e* is located within the channel **102** and secured by the cap **46***e*.

Upon application of power, the heat of the cable is transferred through the channel members **102** and supports **100** into the body **32***c*. A controlled discharge of the snow held by the fence provided from the supports **100** in channel members **102** is provided with progressive thawing as the heat is applied through the cables.

In a further embodiment shown in FIG. **12**, the heating apparatus **30***f* is used in conjunction with a ductile pipe **104**, such as may be used for soil or waste water. As can be seen in FIG. **12**, the body **32***f* of the apparatus **30***f* is curved to conform to the outer surface of the pipe **104**. A channel **106** is formed on the outwardly directed convex surface to receive a cable **58***f* and is closed by a top cap **46***f*.

The body **32***f* tapers towards the opposite lateral edges and is held in situ by bands **110** or other suitable fasteners. In use, the bodies **32***f* are aligned along the pipe **104** over the area to which the heat is applied. The channels **106** are aligned so the cable may run along the length of the pipe **104** and transfer heat through the body **32***f* to the walls of the pipe **104** over an extended area.

If preferred, the cable may be inserted after the pipe has been buried or covered by using the channel as a race for the cable.

Although the invention has been described with reference to certain specific embodiments, various modifications thereof will be apparent to those skilled in the art without departing from the spit and scope of the invention as outlined in the claims appended hereto.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. Heating apparatus comprising a body of conducting material having oppositely directed surfaces extending between said edges, a channel formed one of said surfaces and extending between said side edges, said channel being defined by a pair of walls upstanding from said one surface, and a cover detachably secured to said walls and cooperarting with said side walls to define an enclosed passageway to receive a heating cable said surfaces converging from said channel toward an outer edge of said body.

2. Heating apparatus according to claim **1** wherein said surfaces are planar.

3. Heating apparatus according to clam **1** wherein said surfaces are curved.

4. Apparatus according to claim **1** wherein said cover and said walls are provided with interengaging formations to releasably secure said cover to said walls.

5. Apparatus according to claim **4** wherein said cover has a plurality of ribs formed on an outer surface thereof.

6. Apparatus according to claim **1** wherein said body is cranked adjacent one edge of said body and said channel is formed between said one edge and said crank.

7. Apparatus according to claim **6** wherein said surfaces converge from said crank toward the other of said edges.

8. Apparatus according to claim **7** wherein said crank forms an obtuse angle in said body.

9. Apparatus according to claim **1** wherein said channel is located centrally between outer edges of the body and said opposed surfaces extend to either side of said of said channel to define a pair of flanges.

10. Apparatus according to claim **9** wherein said flanges are inclined to one another.

11. Apparatus according to claim **10** wherein said flanges intersect at 90°.

12. Apparatus according to claim **1** wherein said conducting material is selected from the group comprising aluminium or aluminium alloys.

13. Apparatus according to claim **12** wherein a barrier material is applied to at least one of said surfaces to inhibit galvanic corrosion.

* * * * *